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Pesticide and Water Quality Study, Lake Chicot Mississippi River Basin, Arkansas. Study of Endrin and Dieldrin Pesticide Pollution of Upper & Lower Lake Chicot

Dept of Health, Education and Welfare, Baton, Rouge, LA

Prepared for

Army Engineer District, Vicksburg, MS

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PESTICIDE AND WATER QUALITY STUDY LAKE CHICOT MISSISSIPPI RIVER BASIN ARKANSAS

Study of Endrin and Dieldrin Pesticide Pollution of Upper and Lower Lake Chicot

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

NOVEMBER 1965

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From an analysis of samples collected in June and September 1965, it is concluded that endrin and dieldrin are reaching both the upper and lower portions of Lake Chicot. The concentrations found do not indicate lethal hazards to fish for which median tolerance levels are available. Information is not available to allow evaluation of the effects on other aquatic life in the range of pesticide concentrations found.

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PESTICIDE AND WATER QUALITY STUDY
LAKE CHICOT
MISSISSIPPI RIVER BASIN
ARKANSAS

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This study was requested by the District Engineer, U. S. Army Engineer District, Vicksburg, Mississippi.

Lower Mississippi River Technical Assistance Project
Public Health Service
U. S. Department of Health, Education and Welfare
Baton Rouge, Louisiana
November 1965

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Authority for Project

Investigation of chlorinated hydrocarbon pesticide pollution, principally endrin and dieldrin, of Upper and Lower Lake Chicot, Arkansas was undertaken by the Lower Mississippi River Technical Assistance Project, a Department of Health, Education and Welfare, Public Health Service program. This study was made at the request of the District Engineer, U. S. Army Engineer District, Vicksburg, Mississippi by letter of May 27, 1965. 1/

Background Information

Lake Chicot is an oxbow lake in the alluvial valley of the Mississippi River approximately 20 miles north of the Louisiana State Line in Chicot County, Arkansas. Lake Village, the Chicot County Seat, is located mid-way on the West boundary of the lake. The lake has a low stage volume of approximately 50,000 acre-feet, averages about one half mile in width and is about 17 miles in length. The land area draining into Lake Chicot is used primarily for agricultural purposes with the principal crops grown being cotton, soybeans, and rice.

Prior to 1921 the area north of the latitude of Rohwer, Arkansas drained into the Mississippi River through a gap in the levee known as Cypress Creek Gap, and except during extreme floods on the Mississippi River, only local drainage flowed through Lake Chicot. In 1921 Cypress Creek Gap was closed by the State of Arkansas and the Cypress Creek drainage was diverted to Macon Lake. Macon Lake drained through Connerly Bayou to Lake Chicot which in turn drained through Ditch Bayou to Bayou Macon.

1/ See Appendix A.

During the flood of 1927, the levee along the Arkansas River was crevassed and large quantities of water flowed down the drainage ditches greatly enlarging Connerly Bayou and Ditch Bayou. Fine silts and clays were spread over the bottom of Lake Chicot and the scour in Ditch Bayou resulted in a lowering of the low-water level of Lake Chicot by 4 to 5 feet. During the same flood, dams along Canal 19 were destroyed increasing the flow through Lake Chicot by approximately 30%.

At present the level of Lake Chicot fluctuates between a low stage of 103.0 feet and a high stage (reached in May 1958) of 117.9 feet. All rains in the drainage area above the lake of one-inch intensity or more result in measureable fluctuation of the lake level and muddying of the lake water. The top four to six feet of the lake bottom is composed of semifluid deposit. Sediment entering the lake along with disturbance of the semifluid bottom deposit results in the muddy state of the lake observed over most of the year. About 70 acre-feet of sediment is deposited in the lake annually.

Purpose and Scope of Investigation

The purpose of this investigation was to determine the concentrations of the chlorinated hydrocarbon pesticides, endrin and dieldrin, in the water and bed materials of Lake Chicot at two different lake conditions. Determinations were made above and below the flood control dam which separates the upper lake from the lower lake. In addition to the pesticide analyses, other chemical and physical water quality parameters were measured and are reported.

The sampling program for this investigation was designed to compare the pesticide concentrations and other water quality parameters in the two lakes. A location map is shown on Figure 1.

Sampling Program

For the purpose of this investigation two range stations were selected on the upper lake and three were selected on the lower lake. In addition, one sampling station was located on the Connerly Bayou to sample inflow into the lower lake, and one on Ditch Bayou to sample the outflow from the lower lake. Location of these range stations can be found on Figure 2. General information relative to these sampling stations can be found in Table 1. The types of samples collected were water samples, including suspended sediment, and bed material.

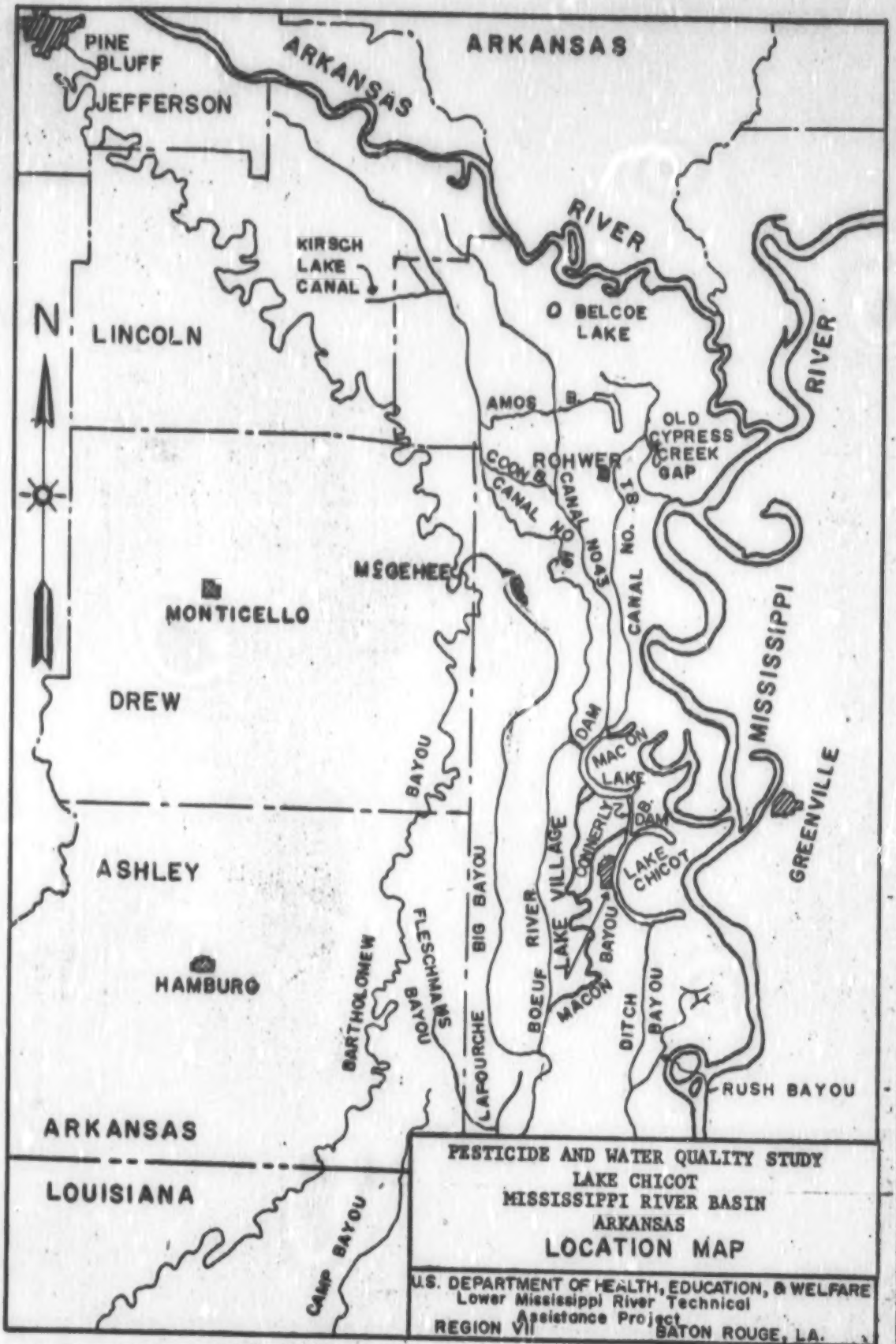
TABLE 1

INFORMATION RELATIVE TO SAMPLING STATIONS

		WATER DEPTH (FEET)							
		High (118.0)*		Low (103.0)*		June (104.3)		Sept. (103.1)	
	Approximate Dist. From	Max	Ave	Max	Ave	Maximum		Average**	
STATION	Dam (Miles)					June	Sept	June	Sept
R-D	3.06 Above			14	8	18	19	15	13
R-C	0.95 Above	34	25	19	13	22	25	18	17
R-12.1	0.82 Below	34	25	19	13	18	19	16	17
R-8.4	4.57 Below	43	31	28	19	29	30	23	23
R-5.5	7.47 Below	43	31	28	17	27	27	18	19

*Data computed from U. S. Corps of Engineers drawings of the permanent ranges on Lake Chicot.

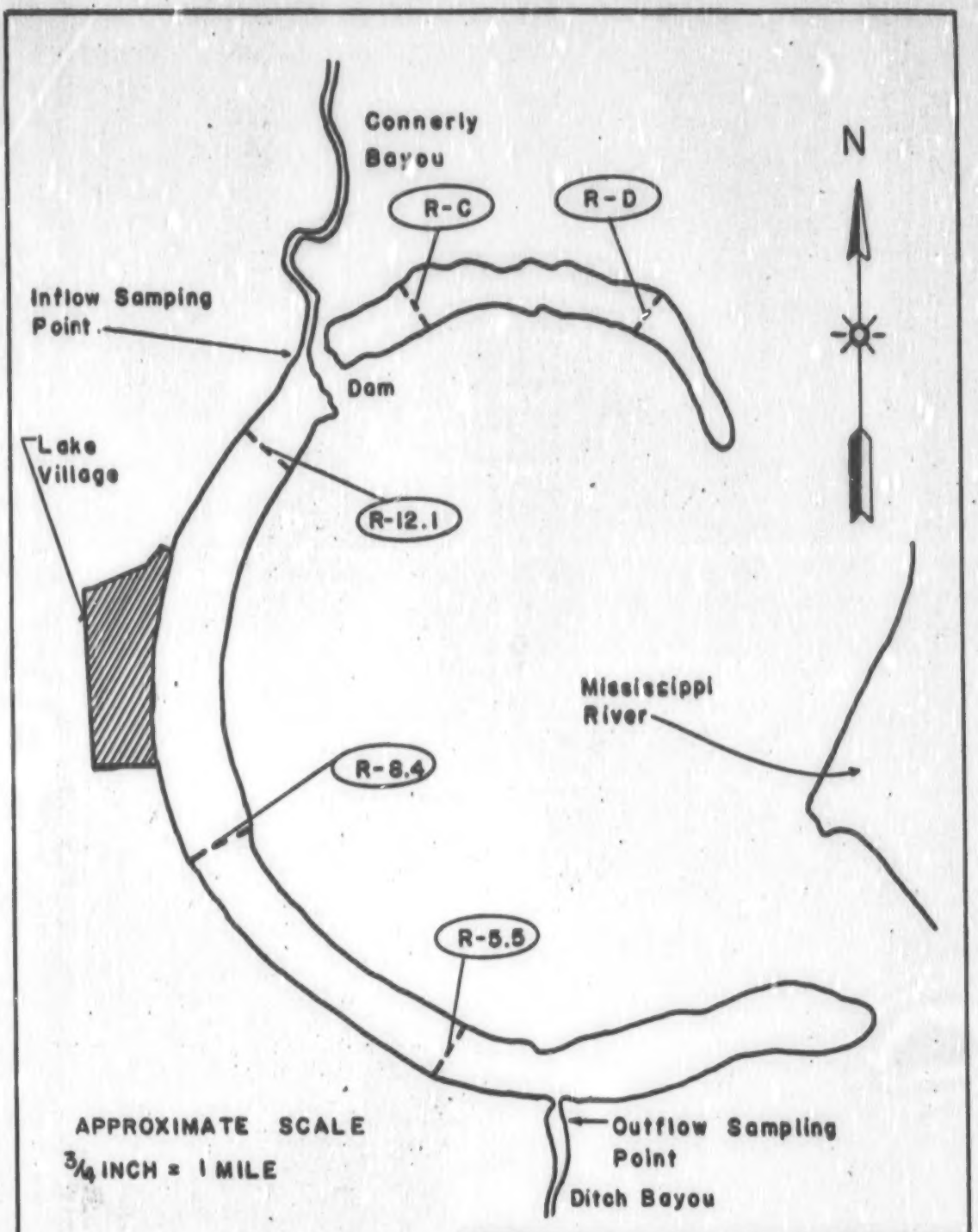
**Average of five vertical sampling points.



PESTICIDE AND WATER QUALITY STUDY
LAKE CHICOT
MISSISSIPPI RIVER BASIN
ARKANSAS
LOCATION MAP

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
Lower Mississippi River Technical Assistance Project
REGION VII
BATON ROUGE, LA.

FIGURE I



PESTICIDE AND WATER QUALITY STUDY
LAKE CHICOT
MISSISSIPPI RIVER BASIN
ARKANSAS

SAMPLING RANGES

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
Lower Mississippi River Technical Assistance Project
REGION VII BATON ROUGE, LA.

FIGURE 2

Cross-sectional samples were obtained at each of the five range stations using five sampling verticals at each station. Water and suspended sediment samples were collected by the depth integrated method at each vertical using the U. S. D-49 Depth Integrating Suspended Sediment Sampler, and bed material samples were also collected at each vertical using the U. S. BMH-60 Bed Material Sampler. These samplers were designed at the Federal Interagency Committee on Water Resources Sedimentation Research and Development Project located at the St. Anthony Falls Hydraulics Laboratory in Minneapolis, Minnesota. After determining the total width of a range, sampling verticals were selected at 10, 30, 50, 70 and 90 percent of the distance from the reference point. Buoys were placed at each of these verticals. The same procedure was used for locating sampling verticals on each of the five range sampling stations on the upper and lower lakes. At the inflow and outflow bayous one sampling vertical was used at mid-stream. The same type of samples were collected in the bayous as had been collected at the range stations.

Field Observations

During the June 1965 sampling, the upper lake appeared clear and was being extensively fished during the sampling period. The lower lake appeared very turbid and no fishing was observed during the sampling run.

On July 3, 1965 about 1200 acre-feet of water was released from the upper lake to the lower lake, and on July 24, 1965 approximately 800 more acre-feet of water was released.

During the September 1965 sampling both lakes were clear and were being fished extensively.

Analytical Methods

Chlorinated hydrocarbon pesticides in water and bed material samples were analyzed quantitatively according to the method of Breidenbach, et al (PHS Publication No. 1241) using a Microtek Model GC 2000 R Electron Capture Gas Chromatograph for precise measurements and a Microcoulometric Titration Gas Chromatograph for confirmation. Thin layer chromatography was used for separation of the chlorinated hydrocarbons and for removal of interfering compounds.

Turbidity, total solids, suspended solids, and volatile solids were analyzed according to "Standard Methods for the Examination of Water and Wastewater", Eleventh Edition, 1960, published by the American Public Health Association, Inc.

In the field, dissolved oxygen determinations were made using the Alsterberg modification of the "Winkler Method". Conductivity and pH were determined by use of portable instruments manufactured by Industrial Instruments, Inc. and Analytical Measurements, Inc. Temperature was measured by a pocket model mercury thermometer.

Results of the Field Study

Range cross-sections and analytical results of samples obtained are shown in Appendix B.

Discussion and Conclusions

The analytical results obtained in this study were subjected to standard statistical tests. The 5% level of significance was used. Statistical methods and equations used for data evaluation are given in Appendix C.

Analytical results for ten water samples for each vertical range station were compared. These represent five depth integrated water samples from each of the two sampling days in June 1965. When the "t_d" test was used, the endrin concentrations in samples obtained at the range stations R-C and R-D on the upper lake were determined to have equal sample means. The sample mean of R-C was statistically compared to the means of three ranges on the lower lake. The sample mean of R-12.1 was found to be significantly higher in endrin content than R-C and R-5.5, but not significantly higher than R-8.4. A comparison of the endrin concentrations in the composite water samples obtained in both the upper and lower lakes during the June sampling period showed no significant differences between the two lakes. When a similar comparison of composite water samples obtained in September was made, again no statistically significant differences were found.

When the bed material samples were subjected to statistical analysis, it was found that endrin concentrations in the bed samples obtained at R-C and R-D were not significantly different. Endrin con-

centrations in bed samples obtained at R-12.1 were significantly lower than those obtained at R-C and R-D in the upper lake and R-8.4 and R-5.5 in the lower lake.

No statistically significant differences could be found in dieldrin concentrations between water samples obtained at R-C and R-D. Dieldrin concentrations in water samples obtained at R-12.1 were significantly higher than at R-C, R-D and R-5.5 but not significantly higher than at R-8.4. Dieldrin concentrations of bed material samples showed no statistically significant differences at the five ranges sampled.

Investigation of other chemical and physical parameters showed the lower lake to be more turbid and to contain more total and suspended solids than the upper lake during the June sampling period.

Endrin concentrations in composite water samples obtained from Upper Lake Chicot varied from 0.02 to 0.07 ug/1. Endrin concentrations in composite water samples obtained from the Lower Lake Chicot varied from 0.02 to 0.29 ug/1. Dr. Tarzwell reports an endrin 96 hour Tl_m of 0.6 ug/1 for bluegill, 0.5 ug/1 for trout, and between 0.2 and 0.4 ug/1 for catfish.2/ Dr. Mount reports that in continuous flow experiments lasting eleven

2/ Volume 1, Proceedings, Conference in the Master of Pollution of the Interstate Waters of the Lower Mississippi River, May 5-6, 1964, New Orleans, Louisiana, Dr. C. M. Tarzwell, Chief, Aquatic Biology Section, Basic and Applied Science Branch, PHS, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

months it was indicated that endrin was toxic to fish at water concentrations in the range of 0.3 to 0.5 ug/l. 3/

A depth integrated sample is collected by lowering the sampler from the surface to the bed of the stream, and returning the sampler to the water surface at a uniform rate. The sampler used has no valve, so the sample is collected during the entire period that the sampler is in the water. A composite sample is made by combining the samples taken at each vertical into one large container. The sample is then thoroughly mixed, and individual samples are poured off into quart jars.

At R-8.4, one composite water sample contained 0.29 ug/l of endrin and one depth integrated water sample contained 0.39 ug/l of endrin.

On the basis of this short-term investigation it can be concluded that the pesticides endrin and dieldrin are reaching both the upper and lower portions of Lake Chicot. The land area draining into Lake Chicot is used primarily for agricultural purposes. The principal crops grown in this area are cotton, soybeans, and rice. Endrin is used on cotton and other chlorinated hydrocarbons are used on cotton and soybeans.

Endrin and dieldrin concentrations found in the upper and lower portions of Lake Chicot during this investigation do not indicate lethal hazards to fish for which median tolerance levels are available. Information is not available to allow evaluation of the effects on other aquatic life in the range of pesticide concentrations found.

3/ Dr. Donald Mount, Fisheries Research Biologist, Basic and Applied Science Branch, PHS, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

APPENDIX A

U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
U. S. POST OFFICE AND COURT HOUSE BLDG.
VICKSBURG, MISSISSIPPI 39181

In Reply Refer

To Symbol LMKGR

27 May 1965

Mr. George Putnicki
U. S. Public Health Service
Director, Lower Mississippi River
Technical Assistance Project
2695 North Sherwood Forest Drive
Baton Rouge, Louisiana 70814

Dear Mr. Putnicki:

The pesticide sampling program for Lake Chicot, Arkansas, which you left with Mr. Fred Bayley III of this office on your recent visit, should provide the information we need for our survey investigation. We suggest that you substitute Station R-5.5 for Station R-A, since we have more data at this location.

I certainly agree with your plan to coordinate this sampling program with the Arkansas Water Pollution Control Commission.

The information developed in your analyses will be very helpful to us, and I appreciate your cooperation in making this data available.

Sincerely yours,

/s/JAMES A. BETTS
JAMES A. BETTS
Lt. Colonel, CE
District Engineer

APPENDIX B

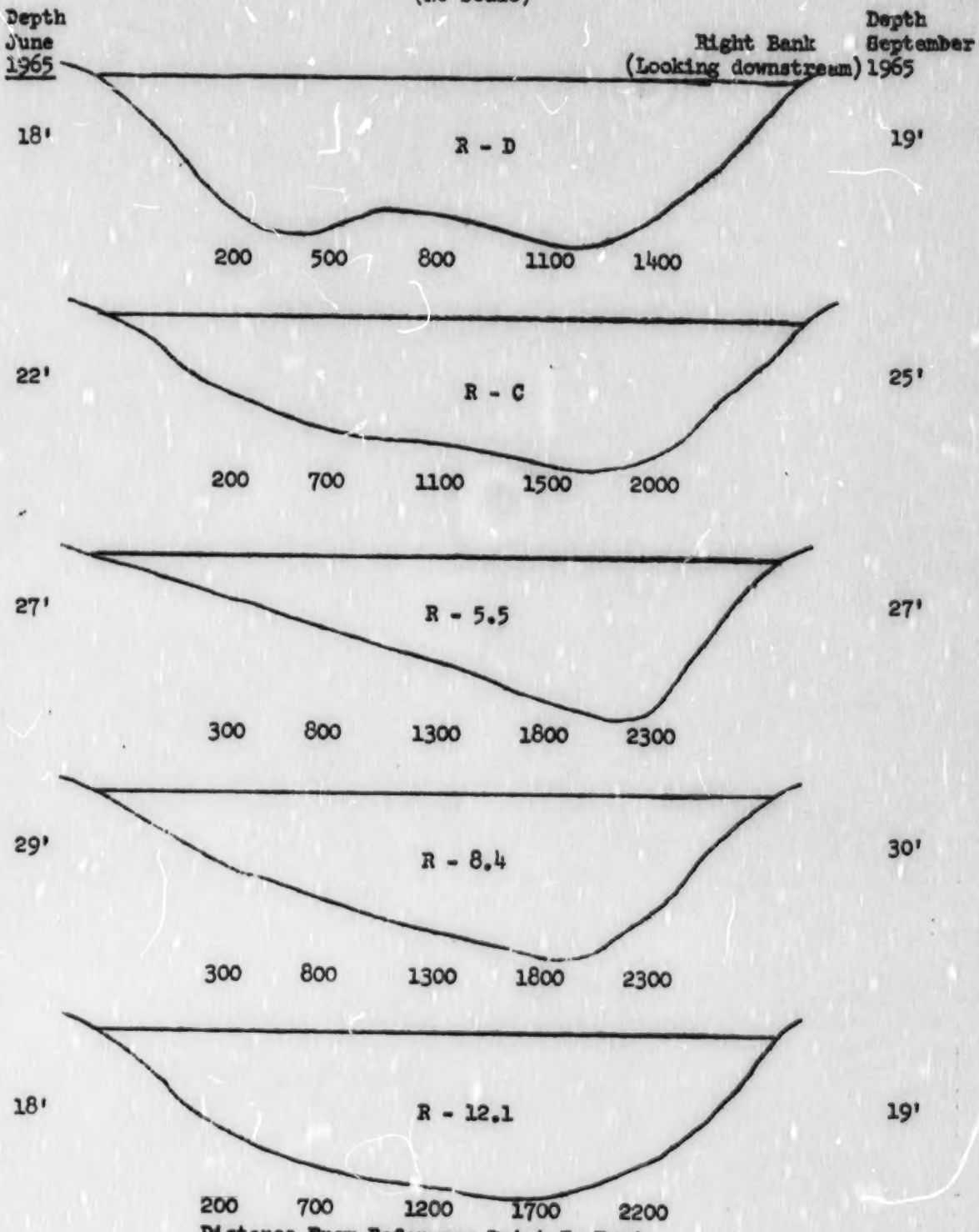
LAKE CHICOT
ENDRIN-DIELDRIN RESULTS AND FIELD PHYSICAL AND CHEMICAL DATA
WATER AND BED MATERIAL

R-D

DIST. FR. BANK	200		500		800		1100		1400		Ave.	Comp.	
DATE (1965)	6-18	6-24	6-18	6-24	6-18	6-24	6-18	6-24	6-18	6-24		6-18	6-24
Water													
Endrin (ug/l)	0.20	0.08	0.01	0.02	0.08	0.01	0.01	<0.01	0.01	0.07	0.05	0.03	0.02
Dieldrin (ug/l)	0.36	0.02	0.02	0.01	0.07	0.01	0.03	0.03	0.02	0.01	0.08	0.02	ND
Bed Material													
Endrin (ppb)	37.00	7.00	14.00	7.00	38.00	20.00	111.00	6.00	9.00	7.00	26.00		
Dieldrin (ppb)	6.00	6.00	3.00	2.00	10.00	10.00	21.00	4.00	5.00	4.00	7.00		
Field physical and chemical data													
pH	8.5		8.6		8.6		8.4		8.4		8.5		
Cond. (mmhos/cm)	620	560	540	540	540	540	530	555	525	540	550		
Temp. (°C)	28.5	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0		
DO (mg/l)	4.4	7.6	5.2	7.2	7.0	7.0	5.8	6.4	6.6	6.8	6.4		

DATE (1965)	9-1	9-1	9-1	9-1	9-1		9-1
Water							
Endrin(ug/l)							0.05
Dieldrin (ug/l)							0.01
Bed Material							
Endrin (ppb)	7.00	3.00	10.00	6.00	8.00	6.80	
Dieldrin (ppb)	13.00	2.00	4.00	3.00	4.00	5.20	
Field physical and chemical date							
pH	8.3	8.3	8.4	8.4	8.5	8.4	
Cond. (mmhos/cm)	595	600	600	600	580	595	
Temp. (°C)	29.0	29.0	29.0	28.0	29.0	29.0	
DO (mg/l)	4.6	3.4	3.6	3.6	4.4	3.9	

LAKE CHICOT
RANGE CROSS SECTIONS
(No Scale)



Distance From Reference Point In Feet.

LAKE CHICOT
ENDRIN-DIELDRIN RESULTS AND FIELD PHYSICAL AND CHEMICAL DATA
WATER AND BED MATERIAL

R-C

DIST. RT BANK	200		700		1100		1500		2000		Ave.	Comp.	
DATE (1965)	6-19	6-23	6-19	6-23	6-19	6-23	6-19	6-23	6-19	6-23		6-19	6-23
Water													
Endrin (ug/l)	ND	0.02	ND	0.03	0.04	0.24	0.02	0.11	0.01	0.11	0.06	*0.02	0.07
Dieldrin (ug/l)	0.01	0.01	0.01	0.01	0.04	0.05	0.02	0.01	0.02	0.01	0.02	*0.03	ND
DDT													ND
DDE													ND
Bed Material**													
Endrin (ppb)	43.00	12.00	293.00	19.00	12.00	17.00	20.00	8.00	18.00	35.00	48.00		
Dieldrin (ppb)	11.00	6.00	30.00	7.00	4.00	4.00	8.00	5.00	5.00	6.00	9.00		
Field physical and chemical data													
pH	8.7	7.5	8.8		8.7		8.3		8.1		8.4		
Cond. (mmhos/cm)	520	530	520	525	515	540	550	555	565	545	535		
Temp. (°C)	28.0	28.0	28.0	28.0	28.0	27.0	27.0	27.0	27.0	27.0	27.5		
DO (mg/l)	6.8	8.9	6.9	8.9	7.0	8.4	7.5	7.8	8.2	6.0	7.6		

DATE (1965)	9-1	9-1	9-1	9-1	9-1	9-1
Water						
Endrin (ug/l)						0.04
Dieldrin (ug/l)						0.01
Bed Material						
Endrin (ppb)	28.00	10.00	7.00	57.00	59.00	32.40
Dieldrin (ppb)	10.00	5.00	3.00	10.00	24.00	10.40
Field physical and chemical data						
pH	8.3	8.4	8.5	8.5	8.6	8.4
Cond. (mmhos/cm)	615	605	595	585	580	600
Temp. (°C)	29.0	28.0	28.0	29.0	29.0	29.0
DO (mg/l)	2.0	3.8	4.4	4.6	5.4	4.0

*Average of two or more laboratory analysis.
** Bed materials collected on 6-19 and 6-24.

LAKE CHICOT
ENDRIN-DIELDRIN RESULTS AND FIELD PHYSICAL AND CHEMICAL DATA
WATER AND BED MATERIAL
R-12.1

DIST. RT. BANK	200		700		1200		1700		2200		Ave.	Comp.	
DATE (1965)	6-21	6-24	6-21	6-24	6-21	6-24	6-21	6-24	6-21	6-24		6-21	6-24
Water													
Endrin (ug/1)	0.23	0.12	0.28	0.05	0.04	0.05	0.04	0.27	0.02	0.23	0.13	*0.04	0.02
Dieldrin (ug/1)	0.12	0.04	0.13	0.02	0.02	0.02	0.02	0.03	0.02	0.12	0.05	*0.03	0.01
DDT												0.50	
DDE												0.06	
Bed Material													
Endrin (ppb)	5.00	6.00	11.00	7.00	6.00	7.00	9.00	9.00	5.00	15.00	8.00		
Dieldrin (ppb)	2.00	4.00	5.00	6.00	4.00	6.00	6.00	7.00	3.00	6.00	5.00		
Field physical and chemical data													
pH	7.4		7.8		7.8		7.6		7.8		7.7		
Cond. (mmhos/cm)	485	490	455	475	455	470	470	465	510	465	475		
Temp. (°C)	27.0	27.0	27.5	27.0	27.5	26.5	27.0	26.0	27.5	26.0	27.0		
DO (mg/1)	6.4	7.0	6.6	6.6	6.3	7.0	6.4	7.2	5.2	6.8	6.5		

DATE (1965)	9-2	9-2	9-2	9-2	9-2	9-2
Water						
Endrin (ug/1)						0.07
Dieldrin (ug/1)						0.01
Bed Material						
Endrin (ppb)	6.00	9.00	5.00	2.00	11.00	6.60
Dieldrin (ppb)	3.00	6.00	2.00	1.00	6.00	3.60
Field physical and chemical data						
pH	8.5	8.5	8.5	8.7	8.5	8.5
Cond. (mmhos/cm)	575	595	590	575	580	585
Temp. (°C)	28.0	28.0	28.0	28.0	28.0	28.0
DO (mg/1)	5.6	5.6	5.8	6.0	6.0	5.8

*Average of two or more laboratory analysis.

LAKE CHICOT
ENDRIN-DIELDRIN RESULTS AND FIELD PHYSICAL AND CHEMICAL DATA
WATER AND BED MATERIAL

R-8.4

DIST. RT BANK	300		800		1300		1800		2300		Ave.	Comp.	
DATE (1965)	6-22	6-25	6-22	6-25	6-22	6-25	6-22	6-25	6-22	6-25		6-22	6-25
Water													
Endrin (ug/l)	0.04	ND	0.04	0.06	0.02	0.07	0.29	0.03	0.05	0.39	0.10	*0.05	0.29
Dieldrin (ug/l)	0.01	ND	0.01	0.03	0.01	<0.01	0.08	<0.01	0.01	0.02	0.02	*0.02	0.10
DDT												0.19	
DDE												0.05	
Bed Material**													
Endrin (ppb)	14.00	9.00	14.00	15.00	6.00	7.00	17.00	36.00	32.00	16.00	17.00		
Dieldrin (ppb)	3.00	5.00	4.00	5.00	3.00	6.00	2.00	15.00	10.00	10.00	6.00		
Field physical and chemical data													
pH	7.5		7.4		7.2		7.5		7.2		7.4		
Cond. (mmhos/cm)	455	465	460	455	455	465	440	460	450	455	455		
Temp. (°C)	27.0	26.5	27.0	26.5	27.0	27.0	27.0	26.0	27.0	26.0	26.5		
DO (mg/l)	6.0	6.2	6.2	6.0	5.8	5.9	6.0	6.0	5.8	5.9	6.0		

DATE (1965)	9-3	9-3	9-3	9-3	9-3	9-3
Water						
Endrin (ug/l)						0.05
Dieldrin (ug/l)						<0.01
Bed Material						
Endrin (ppb)	5.00	20.00	6.00	5.00	4.00	8.00
Dieldrin (ppb)	2.00	6.00	2.00	2.00	1.00	2.60
Field physical and chemical data						
pH	8.5	8.4	8.5	8.5	8.5	8.4
Cond. (mmhos/cm)	580	575	575	575	575	580
Temp. (°C)	28.0	28.0	28.0	28.0	28.0	28.0
DO (mg/l)	6.0	5.2	5.0	5.0	4.6	5.1

*Average of two or more laboratory analysis.
** Bed materials collected on 6-23 and 6-25

LAKE CHICOT
ENDRIN-DIELDRIN RESULTS AND FIELD PHYSICAL AND CHEMICAL DATA
WATER AND BED MATERIAL

R-5.5

DIST. RT BANK	300		800		1300		1800		2300		Ave.	Comp.	
DATE (1965)	6-22	6-25	6-22	6-25	6-22	6-25	6-22	6-25	6-22	6-25		6-22	6-25
Water													
Endrin (ug/l)	0.01	0.04	0.02	ND	ND	0.02	0.24	0.02	0.02	ND	0.04	0.06	*0.10
Dieldrin (ug/l)	0.03	<0.01	0.01	ND	ND	0.01	ND	ND	0.04	ND	0.01	ND	*0.03
DDT												0.52	
DDE												0.06	
Bed Material**													
Endrin (ppb)	4.00	8.00	9.00	7.00	56.00	-	9.00	-	29.00	7.00	16.00		
Dieldrin (ppb)	3.00	4.00	2.00	4.00	19.00	-	6.00	-	6.00	4.00	5.00		
Field physical and chemical data													
pH	7.8		7.8		7.7		7.6		7.6		7.7		
Cond.(mmhos/cm)	479	455	445	445	445	455	445	455	450	455	455		
Temp. (°C)	27.0	26.0	27.0	26.0	27.0	26.0	26.5	26.0	25.0	25.0	26.0		
DO (mg/l)	6.4	6.4	6.4	6.5	6.8	6.4	6.4	6.9	6.2	6.4	6.5		

DATE (1965)	9-2	9-2	9-2	9-2	9-2		9-2
Water							
Endrin (ug/l)							0.08
Dieldrin (ug/l)							0.02
Bed Material							
Endrin (ppb)	19.00	2.00	6.00	2.00	11.00	8.00	
Dieldrin (ppb)	7.00	1.00	3.00	1.00	4.00	3.20	
Field physical and chemical data							
pH	8.6	8.6	8.5	8.5	8.6	8.5	
Cond.(mmhos/cm)	570	565	570	570	565	570	
Temp. (°C)	28.0	28.0	28.0	28.0	28.0	28.0	
DO (mg/l)	5.4	5.6	6.0	5.8	4.4	5.4	

*Average of two or more laboratory analysis.
**Bed materials collected on 6-23 and 6-25.

CONNERLY BAYOU AND DITCH BAYOU
ENDRIN-DIELDRIN RESULTS
AND
FIELD PHYSICAL AND CHEMICAL DATA

STATION	Connerly Bayou			Ditch Bayou		
DATE (1965)	6-21	6-24	9-2	6-23	6-25	9-2
Endrin (water ug/l)	0.08	0.04	0.06	ND	0.09	0.11
Dieldrin (water ug/l)	0.06	<0.01	0.01	ND	0.01	0.01
Endrin (Bed ppb)	11.00	8.00	14.00	5.00	5.00	6.00
Dieldrin (Bed ppb)	6.00	3.00	2.00	3.00	4.00	5.00
Field physical and chemical data						
pH	7.7			8.7		
Cond. (mmhos/cm)	745	955		455	470	
Temp. (°C)	280	26.5		260	25.0	
DO (mg/l)	5.7	4.6		6.6	5.4	

LAKE CHICOT
PHYSICAL (SOLIDS) DATA
JUNE 1965

STATION	R-D		R-C		Connerly Bayou		R-12.1		R-8.4		R-5.5		Ditch Bayou	
DATE (1965)	6-18	6-24	6-19	6-23	6-17	6-21	6-21	6-24	6-22	6-25	6-22	6-25	6-23	6-25
Turbidity (J.U.)	165	230	113	152	290	135	550	230	420	310	255	1000	112	230
Total Solids (mg/l)	406	473	319	248	325	522	553	323	407	333	339	1099	253	368
Fixed	334	313	159	156	325	202	510	298	380	296	273	892	165	238
Volatile	72	160	160	92		320	43	25	27	37	66	207	88	130
Suspended Solids (mg/l)	340	352	152	124	256	76	520	136	288	236	144	1120	92	122
Fixed	244	252	48	48	256	8	416	92	180	124	132	956	48	80
Volatile	96	100	104	76		68	104	44	108	112	12	174	44	42

LAKE CHICOT
PHYSICAL (SOLIDS) DATA
SEPTEMBER 1965

STATION	R - D	R - C	R-12.1	R-8.4	R-5.5
DATE (1965)	9-1	9-1	9-3	9-3	9-2
Turbidity (J.U.)	25	25	25	25	25
Total Solids (mg/l)	231	224	238	199	238
Fixed	150	174	146	191	107
Volatile	81	50	92	8	131
Suspended Solids (mg/l)	70	85	61	48	34
Fixed	68	34	59	5	28
Volatile	2	51	2	43	6

APPENDIX C

STATISTICAL METHODS

"F" Test:

Before the appropriate "t" test was selected, all data was subjected to the "F" test.

$$F = \frac{s_1^2}{s_2^2}$$ where s_1^2 and s_2^2 are the variances of the two sets of observations being compared.

Assumptions:

1. The populations have normal distributions.
2. The samples are random samples drawn independently from the two populations.

The calculated "F" value is compared to the appropriate table value and the hypothesis that the variances are equal is accepted or rejected.

"t_d" Test:

When the "F" test showed that the two sets of observations being compared had equal variances and the sample sizes were equal and consisted of 10 or less observations, the "t_d" test was used.

$$t_d = \frac{\bar{x}_1 - \bar{x}_2}{w_1 + w_2}$$ where $\bar{x}_1$ and $\bar{x}_2$ are the means of the sets of data being compared and w_1 and w_2 are their ranges.

The "t_d" calculated is compared with the appropriate table value at 5% significance level and the hypothesis that the means are equal is accepted or rejected.

Student's "t" Test:

When the "F" test showed that two sets of observations had equal variances but sample sizes being compared were unequal, the Student's "t" test was used.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_o\left(\frac{1}{n_1} + \frac{1}{n_2}\right)^{0.5}}$$

$$s_o^2 = \frac{SS_1 + SS_2}{(n_1 - 1) + (n_2 - 1)} = \frac{\sum (x_{1i} - \bar{x}_1)^2 + \sum (x_{2i} - \bar{x}_2)^2}{n_1 + n_2 - 2}$$

where t = Student's "t"-distribution

$\bar{x}$ = Sample means

x_j = Individual observations

n = Number of observations

SS = Sum of the squares

The "t" calculated is compared with the appropriate table value at the 5% significance level and the hypothesis that the means of the samples being compared are equal is accepted or rejected.

Special "t" Test:

When the "F" test showed that two sets of observations had unequal variances, the following special "t" test was used to compare the means.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{Q}{n_1^2 (n_1 - 1)}}}$$

where $$Q = n_1 \sum_{i=1}^{n_1} u_1^2 - \left(\sum_{i=1}^{n_1} u_i \right)^2$$

$$\bar{x}_1 = \frac{1}{n_1} \sum_{i=1}^{n_1} x_{1i} \quad \text{and} \quad \bar{x}_2 = \frac{1}{n_2} \sum_{i=1}^{n_2} x_{2i}$$

The calculated "t" is compared to the appropriate table value at the 5% significance level and the hypothesis that the means are equal is accepted or rejected.